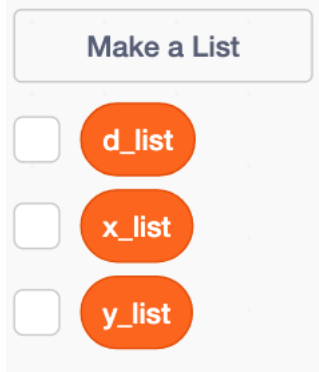# Scratch: Turtle Command Strings

Wouldn't it be great if we didn't have to type the turtle commands one keystroke at a time? Well, I've got some great news; today we will update our Scratch code so we can simply paste a long string of commands into an `ask/answer` text box.
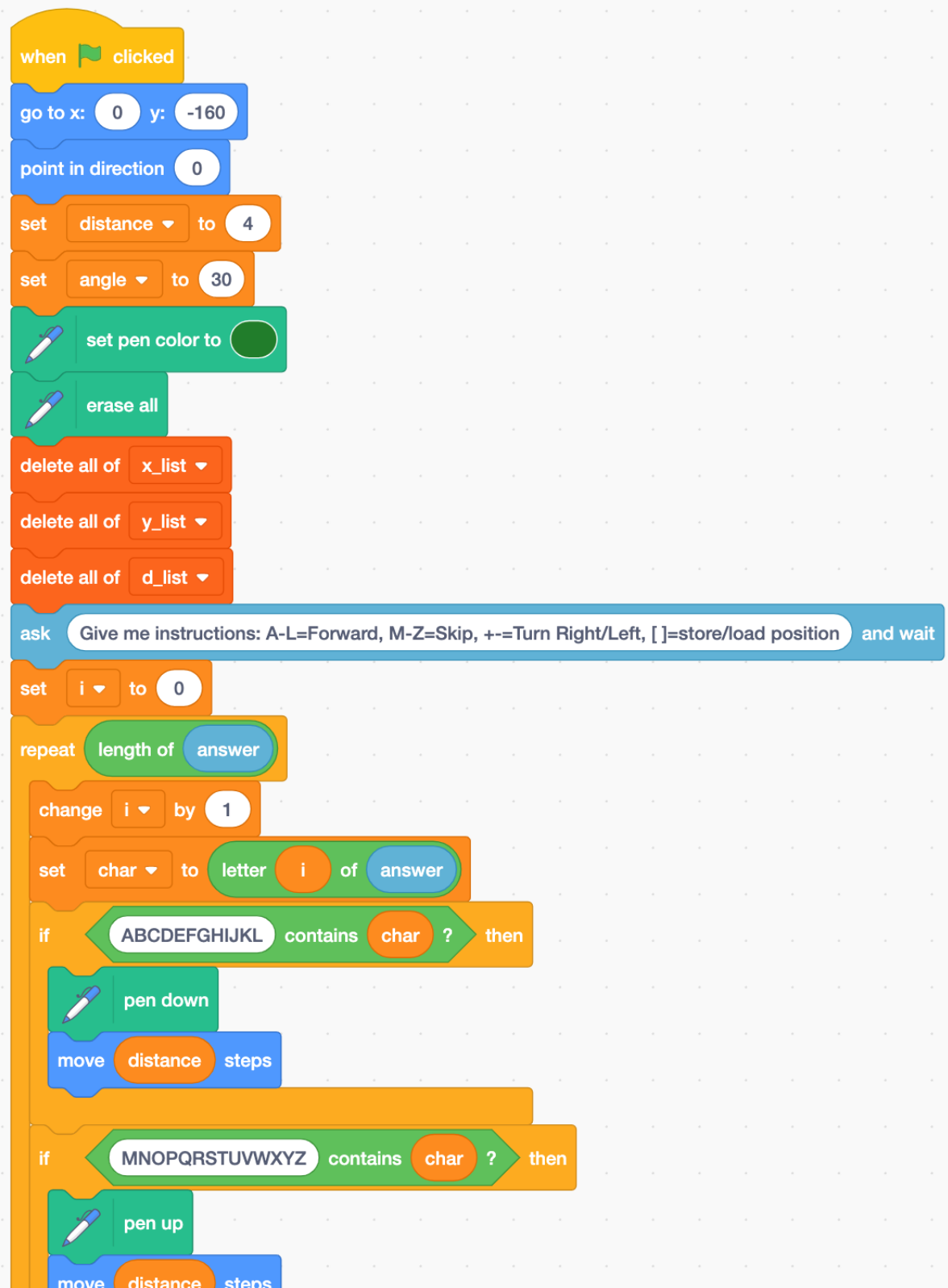
1. **Save your turtle project AS A COPY**. You could name the copy "Turbo Turtle".
2. Make variables.

   Make a Variable

   angle

   char

   distance

   i
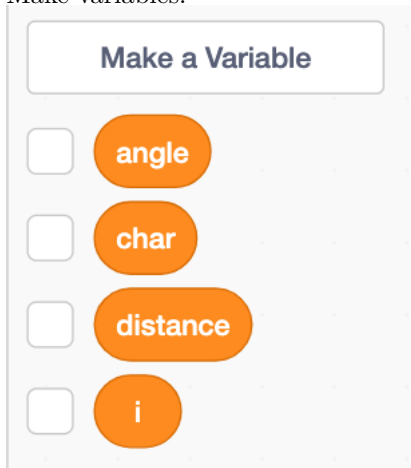
3. Make lists. You probably already have these lists.

   Make a List

   d_list

   x_list

   y_list

4. Alter your code. You'll notice that a lot of the code from your last project is repeated here. It'll be faster to rearrange your old code than rewrite the whole thing.

```
when 🏳 clicked

go to x: 0 y: -160

point in direction 0

set distance ▾ to 4

set angle ▾ to 30

set pen color to ⬤

erase all

delete all of x_list ▾

delete all of y_list ▾

delete all of d_list ▾

ask Give me instructions: A-L=Forward, M-Z=Skip, +-=Turn Right/Left, [ ]=store/load position and wait

set i ▾ to 0

repeat length of answer
  change i ▾ by 1
  set char ▾ to letter i of answer
  if ABCDEFGHIJKL contains char ? then
    pen down
    move distance steps

  if MNOPQRSTUVWXYZ contains char ? then
    pen up
    move distance steps
```

```
pen up

move (distance) steps

if < (char) = ( - ) > then
    turn ↺ (angle) degrees

if < (char) = ( + ) > then
    turn ↻ (angle) degrees

if < (char) = ( [ ) > then
    insert (x position) at (1) of [x_list ▼]
    insert (y position) at (1) of [y_list ▼]
    insert (direction) at (1) of [d_list ▼]

if < (char) = ( ] ) > then
    pen up
    go to x: (item (1) of [x_list ▼]) y: (item (1) of [y_list ▼])
    point in direction (item (1) of [d_list ▼])
    delete (1) of [x_list ▼]
    delete (1) of [y_list ▼]
    delete (1) of [d_list ▼]
```

3

5. Go to this L-system string generator: https://chadworley.github.io/Lsys_string_gen.html
6. Use the following settings:

# L-System String Generator

Axiom (Starting String):

X

Replacement Rules (one per line, e.g., F = F+F-F or A -> AB):

```
F -> FF
X -> F[+XXF+F][-XXF-F]FXX
```

Number of Iterations:

4

7. Click `Generate Strings`.
8. Click `Copy Last String`.
9. Edit the Scratch parameters. We want to start at $(0, -160)$ heading up, have the distance of each step be 4, and the turn angle is 30°. I also think the drawing will look good in green, but you can use any color.
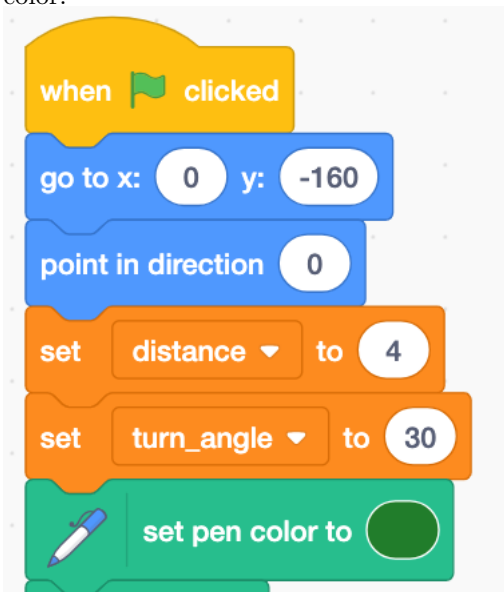
10. In Scratch, click the green flag. Paste the string into the popup. Hit ENTER or RETURN (or click the checkmark). You might find Turbo mode helpful.
11. Take a screenshot of the resulting image (including your turtle). Submit your image on Canvas under assignment `Scratch: L-sys Turtle (pic 3)`.